Research On Effectiveness Of Agricultural Commodity Promotion

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DATA NEEDS TO FACILITATE DOMESTIC PROGRAM RESEARCH

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Introduction

The basic question addressed by this paper covers a broad area: data needs to facilitate research on the effectiveness of domestic agricultural commodity advertising and promotional programs. Of course, discussing data needs without some prior discussion of research questions and methodological directions is a little bit like putting the cart before the horse. Here, one is reminded of a quotation from Sir Arthur Conan Doyle [4] recently used by Leamer [9, pp. 317-318] in his discussion of model choice. In response to a question from Dr. Watson concerning the likely perpetrators of the crime, Sherlock Holmes is said to have replied "No data yet . . . It is a capital mistake to theorize before you have all the evidence. It biases the judgments." Were Doyle an economist, econometrician, or theoretical statistician, he might have had Watson revealing certain facts about the crime, only to be admonished by Holmes: "No theories yet . . . It is a capital mistake to view the facts before you have all the theories. It biases the judgments."

This story has a certain appeal in the present context. While the first warns against placing excessive confidence in the completeness of any set of theories, the second issues a stern warning against theories which are constructed to explain the given facts since they cannot at the same time be said to be supported by these facts. In fact, one could argue that in general many people seem too eager to collect endless facts with very little prior theoretical or methodological orientation. There appears to be a pervasive, and almost singleminded, emphasis on data collection, typically in the form of large surveys, which often passes for "research." One can only hope that future efforts aimed at evaluating the effectiveness of agricultural commodity advertising and promotion programs would avoid such a mistake.

This paper approaches the topic of data needs from the perspective of our current research, on behalf of the National Dairy Promotion and Research Board, to evaluate the effectiveness of the nationwide generic advertising program for fluid milk, cheese, and butter.

At least two reasons motivate the selection of such a perspective. First, the Board's current advertising and promotion effort represents perhaps the most significant program in existence today in the area of agricultural commodities in terms of its sheer size and scope. Second, and more importantly, the Board's research program to evaluate the effectiveness of the generic advertising activities focusing on fluid milk, cheese, and butter has been steadily evolving over the past several months and should soon be reaching a point at which it can start offering useful research guideposts and insights for other commodity promotion efforts.

Accordingly, our current research effort for the National Dairy Promotion and Research Board will be summarized to highlight data-related issues, questions, and requirements. This will lead to certain general conclusions concerning suggested future methodological directions and priorities, as well as associated data requirements. It is hoped that these general conclusions might prove useful in connection with future research efforts to evaluate the effectiveness of various commodity advertising and promotion programs.

Overview of Current Research for the National Dairy Promotion and Research Board

Our current research program for the National Dairy Promotion and Research Board addresses two principal and related questions:

(1) Does the generic advertising program for fluid milk, cheese, and butter lead consumers to increase their purchases of these products?

(2) What is the incremental effect of the generic advertising program on the sales of fluid milk and cheese for direct consumption?

The first question can be posed in the following more specific form: Is there a statistically significant difference between the purchase (and consumption) levels of those households (and individuals) who are exposed to the generic advertising program over some length of time and those who are not?

The second question, meanwhile, concerns the *incremental* effect of the spending levels under the current nationwide advertising and promotional program (which includes the activities of the Board as well as that of the various state and regional dairy organizations) compared with what such advertising spending levels would have been in the absence of the current nationwide program (which would have consisted only of the advertising activities of the various state and regional dairy groups).

A two-track approach has been pursued to address these two key, related, questions:

- Development of econometric demand models of fluid milk and cheese, incorporating generic advertising expenditures and based on aggregate market data, to measure the effect of generic advertising on fluid milk and cheese sales for direct consumption; and,

- Statistical analyses of split-cable scanner data for fluid milk, cheese, and butter for specific test-market areas to measure whether, under conditions approximating controlled experiments, generic advertising leads consumers to increase their purchases of those products.

Let me briefly expand on this two-pronged methodological approach.

1. *Development of Econometric Models of Fluid Milk and Cheese.* Here, we are in the familiar company of many previous researchers who have contributed to the voluminous advertising effectiveness literature. The subject is too broad to be covered quickly. In general, two basic modeling approaches have been taken by various researchers. The first is what Little [11] has called the *a priori* models, which draw heavily on intuition and postulate a general structure on the sales-advertising relationship. In this class of models can be included the work of Vidale and Wolfe [22], Nerlove and Arrow [12], and Little [10]. The second is the statistical or econometric modeling approach [Paldo, 21; Bass and Clarke, 1; Clarke, 2; Hochman, Regev and Ward, 8; and Ward and Davis, 24]. This second group includes, for instance, a number of studies focusing directly on milk or cheese. These include the work of Thompson [13, 15], Thompson and Eiler [16], Thompson, Eiler and Forker [17], Kinnucan [18], Kinnucan and Forker [20], Kinnucan and Fearon [19], and Ward [23].

A number of key ideas have emerged from these earlier econometric modeling efforts. These ideas can be summarized as follows:

First, advertising, as information, shifts the demand curve facing consumers. Advertising may shift the demand function, for example, by adding new customers who may never have consumed the product before, expanding the consumption levels of the present customers, and attracting new customers away from a rival or substitute product. Advertising may alter the tastes and preferences of customers and thereby change the shape of the demand function as well as causing a shift in it. The demand function refers to the main result of the neoclassical microeconomic theory of consumer demand behavior, based on utility maximization subject to a budget constraint. Hence, the rather useful outcome of the "advertising-as-information" concept is that advertising enters the consumer's demand function as a separate variable, in addition to the usual price, income, and other variables.

Second, the microeconomic theory of demand and the literature on econometric analyses of demand offer a rich variety of analytical alternatives for analyzing the effectiveness of generic advertising. The theoretical derivation of estimable demand functions (incorporating advertising) directly from a specified consumer utility function (or

household production function) subject to the usual conditions, is still at a developmental stage. While this direct link between model specification and utility maximization is currently awaiting further theoretical development, single-equation demand models can produce reliable results if theoretical considerations are satisfied to the greatest extent possible. Thus, with the microeconomic theory or consumer demand serving as the basic analytical framework, the effect of advertising on consumption can be determined by isolating the separate effect of advertising by considering, at the same time, the respective individual effects of prices (i.e., own-price, prices of substitutable and complementary products), consumer income, and other relevant variables (e.g., demographic variables, seasonality effects, habit formation, advertising expenditures on competing as well as complementary products, etc.).

Third, advertising can be viewed in basically two alternative ways. One possible way is to view advertising as a "flow" variable, recognizing that the level of advertising expenditures at any one time may be expected to lose its effectiveness in subsequent periods. Under this approach, the temporal differences in the effects of advertising on demand would be represented by including in the demand model a number of dated, past advertising outlays, through the choice of an appropriate distributed lag structure to account for the diminishing influence of advertising expenditures, in a given period, on consumption in subsequent periods.

The alternative way is to view advertising as a "stock," or "goodwill," which depreciates over time like a capital good. Advertising is then measured as the weighted average of current and past advertising expenditures. The weights used may vary, depending upon the decay structure assumed. The "goodwill" concept of advertising has an intuitive appeal as well as the additional advantage of simplicity.

Fourth, however it is measured, advertising has a cumulative effect; that is, the effects of advertising persist beyond the period during which the advertising activity takes place. Since the effect of advertising may not totally dissipate in the period in which the advertisement is seen by the consumers, most of the models use an appropriate distributed lag formulation (e.g., Koyck, polynomial, Pascal) to measure the cumulative effect of advertising.

Invariably, the various econometric modeling efforts in this area have involved the development of single-equation demand models, including, in addition to advertising expenditures, such usual variables as own-price, prices of substitute products, personal income, seasonality, and other factors. In some cases, supply-side effects are also explicitly considered [Thompson, Eiler and Forker, 17].

A major research effort has been directed in the present assignment at the development of pooled time series and cross-sectional econometric models of fluid milk sales for direct consumption, using monthly

data for each of a group of milk regions (i.e., for the period June 1977 – July 1984 for ten milk market regions and for the period December 1978 – July 1984 for twelve regions, the latter including Texas and California). The twelve milk market regions covered in this analysis account for roughly 43% of the total United States population. These twelve milk market regions consist of ten federal milk order regions plus California and Virginia which are not subject to federal orders.

The econometric modeling effort focusing on fluid milk has received much of the research emphasis in the present study. In addition, and on an experimental basis only, an aggregate econometric demand model for cheese has also been developed using national time series data (monthly) on household purchases of cheese for consumption at home. In both the milk and cheese models, the data on advertising expenditures actually precede the sample period over which the model is estimated by a full year; this allows for the specification of a distributed lag structure with as many as twelve periods. Both the fluid milk and the cheese models have been constructed to detect, test for, and quantify the effect (if any) of generic advertising on consumer purchases of these products.

In the course of our econometric modeling work, a series of pooled time series and cross-sectional demand models of fluid milk were developed. One of these models was finally selected, based on objective theoretical and empirical criteria, for analyzing the incremental, as well as the total, effect of the current nationwide generic advertising and promotional program for fluid milk. This was accomplished by simulating fluid milk consumption levels over the period August 1984 – July 1986 under three basic scenarios, assuming no national or regional program(s), as well as "with" and "without" the current nationwide advertising and promotional program.

2. *Statistical Analyses of Split-Cable Scanner Data.* The econometric modeling effort focusing on fluid milk and cheese has been accompanied by statistical analyses of split-cable scanner data for specific test-market areas for fluid milk, cheese, and butter. The main objective of these statistical analyses, which proceeded along a parallel, second track, has been to detect whether two groups of households in specific test-market areas, where one group is exposed to advertising (i.e., experimental or test panel) and the other group is not exposed to advertising (i.e., control panel), display significant differences in terms of their purchases of these products. The two panels are presumed to be similar in terms of their pre-test purchase patterns and in terms of their economic and demographic characteristics. That is, an attempt is made on the part of those organizations collecting such data to "balance" the two panels. Also, individual households in both panels are exposed to the same marketplace variables, for instance, including exposure to generic print advertising on milk, cheese, and butter, as well as to all types of brand-specific advertising (e.g., Kraft, etc.). Hence,

any significant difference between the average consumption levels of the two panels of households is purported to represent the effect of advertising.

A number of statistical methods are available in the analysis of variance literature for detecting significant differences between two or more population means. The basic approach used in this study is the repeated measures analysis of covariance model, in combination with other methods.

The weekly family reporting history data for milk, cheese, and butter that have been made available for use in this study refer to eight specific test-market areas in different parts of the country. These include two test-market areas for butter (located in the Midwest and the Northeast), three areas for cheese (Northeast, West Coast, and Southeast), and four areas for milk (Northeast, Midwest, Southwest, and West Coast). One of the test-market areas in the Northeast serves as a dual test-market area for both butter and cheese, with the same test and control panels.

These test-market areas are typically communities well saturated by cable TV. In these communities, individual cable TV households are recruited and randomly assigned to one of two panels, Panel A (control) or Panel B (experimental or test panel). Each panel has about 1,250 households; thus, the total sample size in each test-market area is about 2,500 households. Panel A (control) receives no milk, cheese, or butter advertisements; instead, through a centralized electronic control mechanism they are provided with certain types of public service advertisements. Meanwhile, Panel B (experimental) receives all of the milk, cheese, and butter advertisements.

Through the scanner technology at the participating supermarkets or through diary-based reporting, the weekly purchasing history of each household in the two panels is recorded and maintained. As a result, the database consists of weekly purchase history data for each participating household for one year for fluid milk or for two years for cheese and butter prior to the start of the advertising campaign, as well as forward or test-period data.

The overall size and scale of the entire microdatabase can be appreciated by noting that for each specific household, the family purchase history data for milk, cheese, and butter, on a weekly basis, include considerable detail, covering information on product price, quantity purchased, deal value (if any), type of product (e.g., whole, lowfat, skim milk, etc.; natural, processed, or imitation cheese; butter, margarine, blends), form and size of the product, and the brand name of the product. In addition, considerable detail is provided on each household's economic and demographic characteristics.

In order to keep the overall analytical task within manageable proportions, the detailed database for each product category has been

aggregated, for each household, into monthly accounting periods. Further, product details have been aggregated into broad higher level product categories, resulting in five product categories for milk (i.e., whole, lowfat, skim, flavored, buttermilk, and other), three categories for cheese (i.e., natural, processed, imitation), and three categories involving butter and related products (i.e., butter, margarine, blends). Separate statistical analyses have been performed at this latter level of product detail, in order to detect the possible effect of advertising specifically for each such product category or sub-category.

Suggested Future Methodological Directions and Data Requirements

In thinking towards future methodological directions and associated data requirements, which is the subject of this section, a distinction is made, more for practical than for conceptual reasons, between econometric models using aggregate time series data (or pooled time series and cross-sectional data), and analytical methods using micro-level observations on individuals (or households), such as those represented by split-cable scanner data. In both cases, a few words of caution are first offered before indicating suggested future methodological directions and data requirements.

1. *Econometric Models Based on Aggregate Data.* If properly constructed by using reliable data, aggregate econometric models can be quite informative. However, they are also limited by the very fact of being based on aggregate or grouped data. Consumer preferences are implicitly assumed to be homogeneous over all individuals. All individuals are also implicitly assumed to be equally exposed to the advertising program. In view of the *ex post facto* nature of the data, it is not possible to construct control or experimental groups. In the presence of multiple casual variables, an imperfectly specified and estimated model may lead to incorrect conclusions on the effectiveness of advertising. This may perhaps be countered by asserting that there is no such thing as a perfect econometric model. Nevertheless, there still exist certain analytical dangers, since the model may well run the risk of being data-instigated. Finally, the dynamics of the effect of the advertising activity on sales are typically captured by the advertising expenditures variable alone. Such factors as consumer exposure, awareness, recall, and recognition are not considered.

For these reasons, a great deal more can and should be done to construct reliable econometric models, using aggregate time series data, or more preferably, combined time series and cross-sectional data. Time series and cross-sectional models have become increasingly important in econometric analyses of advertising effectiveness. Considerable variability over different observational units, both cross-sectionally and over time, in terms of prices, income, level of exposure to advertising, and other factors, allow for the disentanglement of the various effects

which is often quite difficult to do with aggregate time series data only. Greater emphasis on pooled time series and cross-sectional models should be augmented by developing additional data on demographic variables and on competing as well as complementary products. Further, data on advertising expenditures for both competing and complementary products, as feasible, should be developed.

Further, in the longer-run, the development of simultaneous-equation models of interrelated products and markets (e.g., a detailed dairy industry model) should be considered in order to analyze the cross-market or cross-product demand-side, as well as supply-side, effects of advertising and promotional programs.

2. *Analyses Based on Split-Cable Scanner Data and Similar Micro-databases.* First, a number of observations pertaining to the key advantages and disadvantages of using split-cable scanner databases, or similar databases, for specific test-market areas should be quickly noted. The acquisition of split-cable scanner data is a routine and time-tested procedure. The primary advantage or benefit to be derived from the use of split-cable scanner data is that each test-market area presumably represents a controlled experimental situation. Thus, the direct comparisons between the "control" and "treatment" panels can yield tangible and often clear differences that can be associated with the advertising program. The reliability of the results is enhanced by the panel-to-panel comparisons. Also, often media costs can be minimized by limiting the advertising campaign to just the specific test-market areas.

These benefits, however, need to be weighed against some of the potential limitations of this research approach. For example, in reviewing historical purchase patterns, primarily in two butter markets, we have noted a few characteristics that have analytical implications. For instance, there appears to be no attempt to estimate the effects of "non-respondents"; that is, households that do not use their card at any time during a reporting period are simply ignored. This negligence could introduce a bias, since the purchasing patterns of these households might be substantially different from those that do report during any given period.

A similar, and perhaps larger, problem is that of attrition in the two panels, as some participating households exist and new households enter the two panels. This subject has been a source of considerable concern in the econometrics literature [see, for instance, Hausman and Wise, 7].

Also of some concern is the potential effect of repeated testing. Since panel households are subjected to other advertising and promotional testing over time, some residual and/or confounding effects might be operative. For example, a cursory inspection of historical butter sales (in dollars) in a Midwestern test-market area revealed a significant "treatment" effect during the summer of 1983. Although the actual

cause of this observed effect is unknown, it does indicate that panels have been exposed to some imposed "treatment" that appears to have influenced butter purchases in the past. Consequently, it may be conjectured that panels are not truly representative of the buying public as a whole or, more importantly, they yield biased results because of prior or concurrent test efforts.

Further, a general impression seems to be that the "control" and "experimental" panels are "balanced," at least in the sense that the two panels exhibit statistically equivalent sales patterns in the product being tested prior to the commencement of the advertising campaign. This, however, is not necessarily the case. It was noted, for instance, that historical sales (i.e., butter, in both pounds and dollars, over two years prior to running the test advertisement) were constantly and, in many reporting periods, substantially greater in one panel than in the other.

In addition, the following types of potential limitations should be noted:

- The community-specific results generally do not lend themselves to drawing defensible broad nationwide or regional inferences;
- Out-of-home consumption is typically omitted from the analysis;
- The purchasing behavior of the 18- to 24-year-old population group, including particularly college students, is generally poorly covered.

Because of these types of actual or potential limitations, the results of such localized tests should be used, not on a stand-alone basis, but as buttressing evidence in conjunction with a research approach designed to assess the program's effectiveness nationwide (as well as by broad regions, as needed), the latter requiring the development of combined time series and cross-sectional models using aggregate market data and/or as econometric models using micro-level data on individuals (households) from a nationwide consumer panel database.

These points should not obscure the fact, however, that a great deal might potentially be learned about the dynamics of demand from econometric analyses of the split-cable scanner databases. In particular, the potentially powerful capability of such analyses to pinpoint the key determinants of demand for various specific products, especially by considering the influence of household demographic characteristics on demand, should be recognized. At the same time, the availability of such databases can lead to comprehensive analyses of competition, or complementarity, among various products. The results of such analyses would quite likely yield considerable practical benefits in terms of targeting advertising campaigns with greater precision to specific population segments and also in terms of helping devise a better "mix" of media strategies, in order to maximize advertising effectiveness.

Concluding Remarks

The main direction for future research lies in the development and analysis of microdatabases, using, for instance, qualitative and limited dependent variable econometric modeling techniques. These databases would include split-cable databases for specific test-market areas, as well as special nationwide consumer panel data.

The concept of a nationwide consumer panel may warrant serious consideration in this general context. The idea is basically to establish and maintain a special diary-based national panel of individual consumers based on stratified random sampling to assure the adequate representation of various demographic groups in the population and, of course, to assure nationwide projectability. The diary-form to be filled out by the panel participants on a weekly basis would record the actual purchases and consumption of various types of specific products (e.g., dairy products), along with other products. The data to be collected in this manner would include information on prices and on various non-price attributes associated with the products covered.

With this panel as the primary survey instrument, a number of "waves" of follow-on contacts may then be performed, for instance, each time covering a random sample of the panel and using sampling without replacement. The objective of the follow-on contacts to be performed, perhaps by phone or through supplementary questionnaires, would be to test for the respondents' awareness, recall, and content recognition of the advertisements, by also asking a broader set of other questions. An important aspect of these follow-on contacts would also be to obtain data on the respondents' TV viewing behavior.

The expected results of this would be two-fold:

(1) It would be possible to track actual purchases and consumption over time, where one can account, through econometric methods, for the temporal effects of changes in relative prices, seasonality factors, and other pertinent time-varying factors, as well as for individual-specific characteristics, in order to isolate the effects of specific advertising programs *per se*, and

(2) It would be possible to classify the respondents into different categories of awareness, recall, and recognition, such that the research design can approximate the equivalence (or near-equivalence) of a controlled nationwide experiment.

Having thus collected the data, it would then be feasible to proceed to develop econometric models, in order to quantify the duration of the advertising effect, to measure the incremental effect of the various advertising programs, and to test for significant differences in the consumption of dairy products by different categories of consumers (including pre-test, and post-test comparisons), while controlling for

the effects of the various key variables conditioning the consumption of specific dairy products.

In short, such a special nationwide consumer panel can help interconnect awareness, recall, and related factors with actual consumption, provide a longitudinal database to detect and measure the influence of critical time-varying and individual-specific variables, and provide a more complete research design for answering key questions.

In conclusion, a clear research direction for the future is the construction of econometric models using microdatabases consisting of longitudinal observations on specific individuals or households. In fact, many surveys, instead of being limited to a single cross-section, now track given individuals over time. Such panel databases provide a rich body of information, given the wide variability among individuals and also in view of the fact that given individuals exhibit much less variability over time. Analyses of split-cable scanner data for specific test market areas represent a move in this general direction. The devlopment of special nationwide consumer panel data is also strongly suggested in this general context.

The time has come (some may say it is long past) in research focusing on the effectiveness of advertising and promotional programs, not only for agricultural commodities, but also for other products, to move clearly in the direction of developing microdatabases with the objective of building behavioral models of consumer demand and, by extension, building microdynamic models of individual markets as well as linked models of interrelated markets.

It must be emphatically noted that the econometrics "know-how" of today, if creatively utilized, has a great deal to offer in this general connection; its great analytical power still remains to be tapped. Herein, also, lies a major challenge in applied econometrics for many years to come. The concluding message of this paper, then, is that we need both new data and new analytical techniques, represented particularly by emerging econometric methods for longitudinal data analysis, to forge ahead in this exciting area.

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